

Water Distribution Systems Design for Northern Vallecito, Panama



Project Overview

Agua de Abajo Engineering traveled to Vallecito, Panama (shown in Figure 1) in August 2013 to collect data for the design of a water distribution system. A system was designed to provide all interested households with a reliable supply of potable water. Design challenges included pressure problems due to mountainous topography, the need to cross a river, and financial constraints.



Figure 1: Map of Panama

Project Goal

Design a gravity fed water distribution system and possible alternatives to provide potable water for 41 people (15% of the community) with 30 gallons/person/day.

Community Background

- Village settled about 70 years ago, school established 65 years ago
- Latino, Spanish-Speaking
- Approximately 70 households (300 people)
- Economy based on agriculture (products include coffee, bananas, chicken, oranges, beef, rice, etc.) and nearby construction projects

Data Collection

Abney Level Surveying: Obtained elevation profile of systems in order to determine feasibility of gravity-fed system (see Figures 3 and 5 for elevation data)

GPS X, Y Coordinates: Produced maps of water distribution routes in community

Flow Rate Measurements: Obtained for two springs: Toma 1 and Toma 2 supply 25,000 and 72,000 L/d, respectively

3M Petrifilm Water Quality Testing: Significant microbial contamination present—a chlorination system is recommended (see Figure 7)

Proposed Design

The final proposed design includes two separate gravity fed water distribution systems that serve 10 homes in Northern Vallecito. These two designs utilize separate spring sources, called Toma 1 and Toma 2 (shown in Figure 2). Construction will take two months.

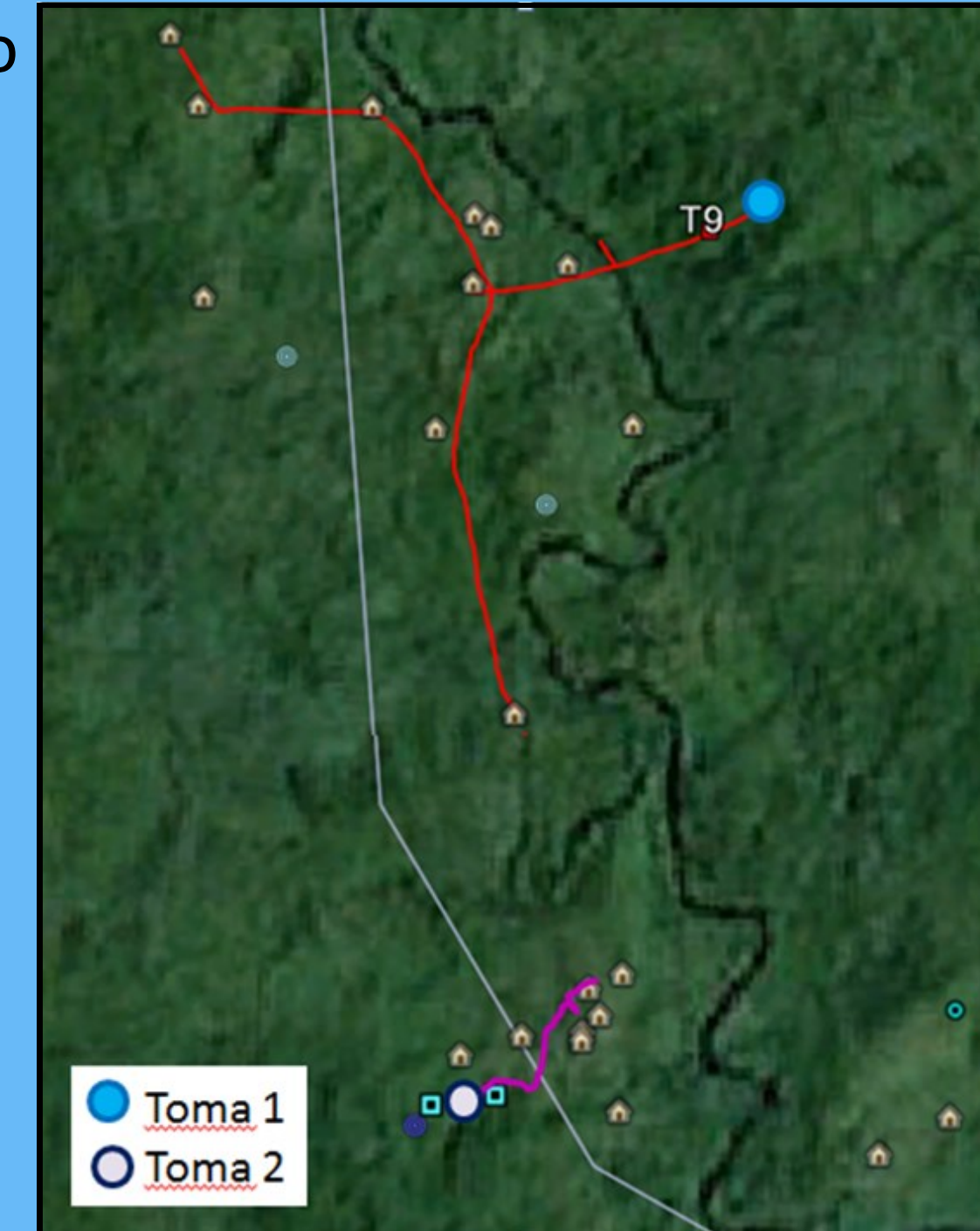


Figure 2: Water distribution system routes

Toma 1	
Component	Cost
Pipeline	\$4,400
Spring Box	\$360
Storage Tank	\$343
Bridge	\$2,300
Valves	\$20
Tapstands	\$75
Transportation	\$960
Total+10%	\$9,300

Toma 2	
Component	Cost
Tapstand	\$10
Pipeline	\$275
Transportation	\$60
Total +10%	\$380

Toma 1 Design Components continued

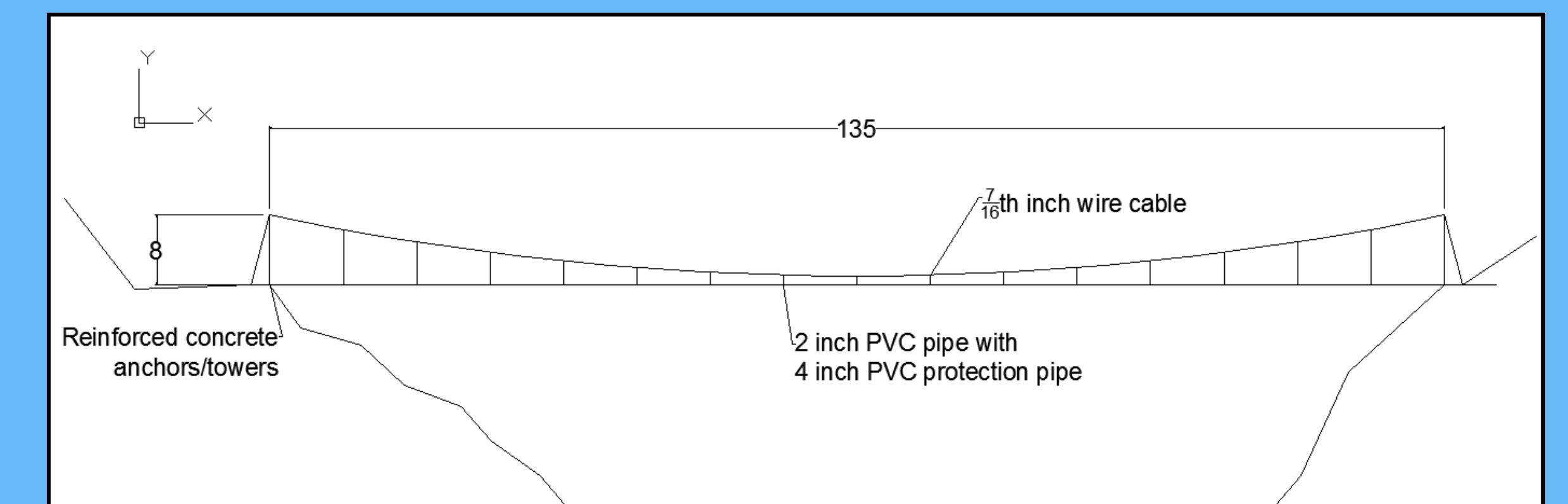


Figure 6: Bridge design (units: m)

Pressure Reducing Valves: One valve on first tee to reduce high pressure at tap
Air Release Valves: Implemented at every high point to reduce air blockages
Tap Stands: Constructed at every house (see Figure 9)

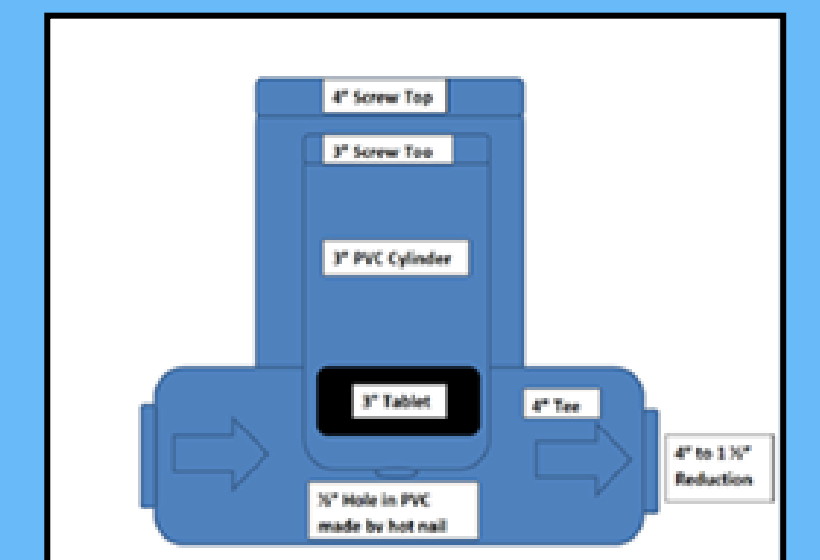


Figure 7: In-line Chlorinator

Toma 1 Design

The first 7 houses in Northern Vallecito are served by Toma 1. The system is made of 2 inch diameter PVC pipe and 1/2 and 1 inch diameter PVC pipe at the tees. The design components and elevation profile are summarized below.

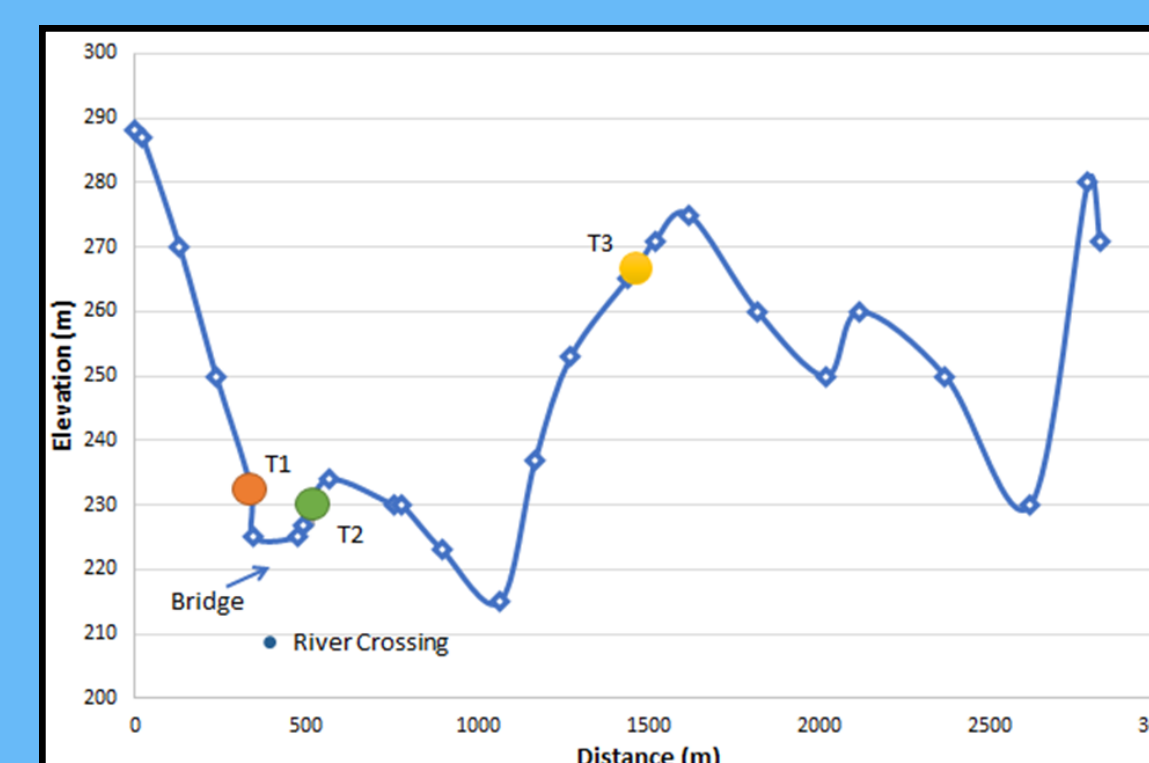


Figure 3: Toma 1 Elevation Profile

Design Components

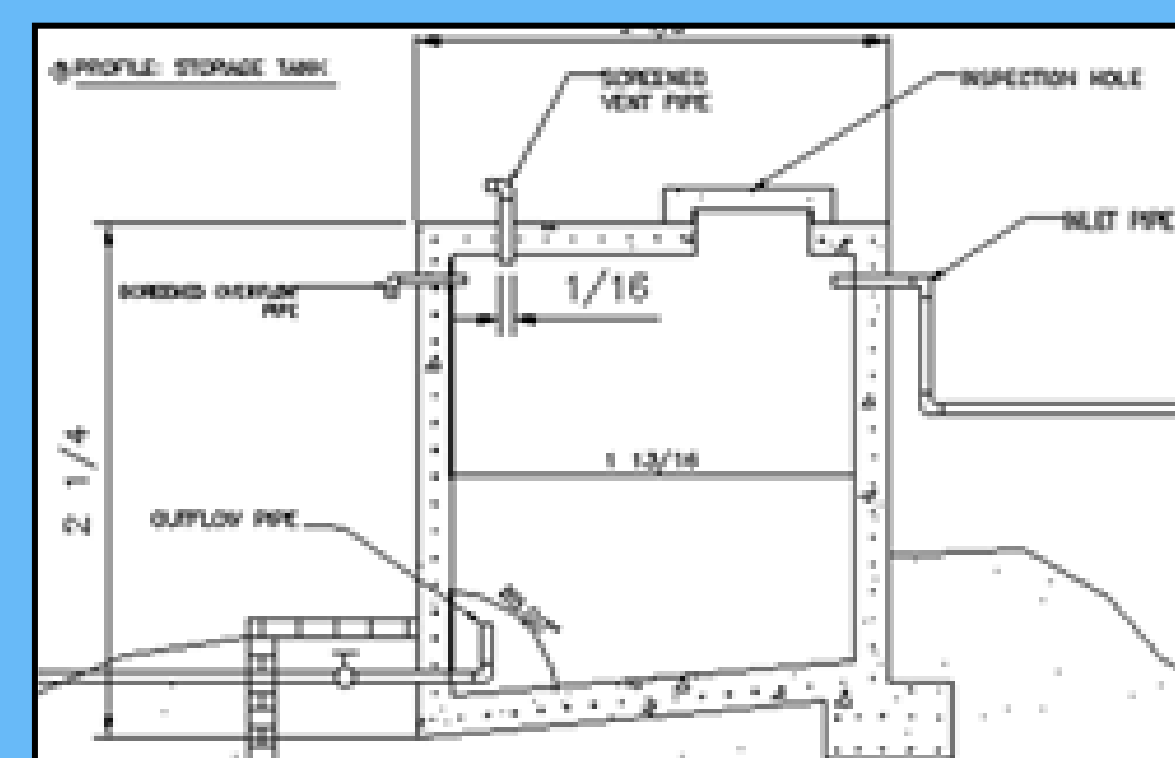


Figure 4: Profile View Storage Tank (units: m)

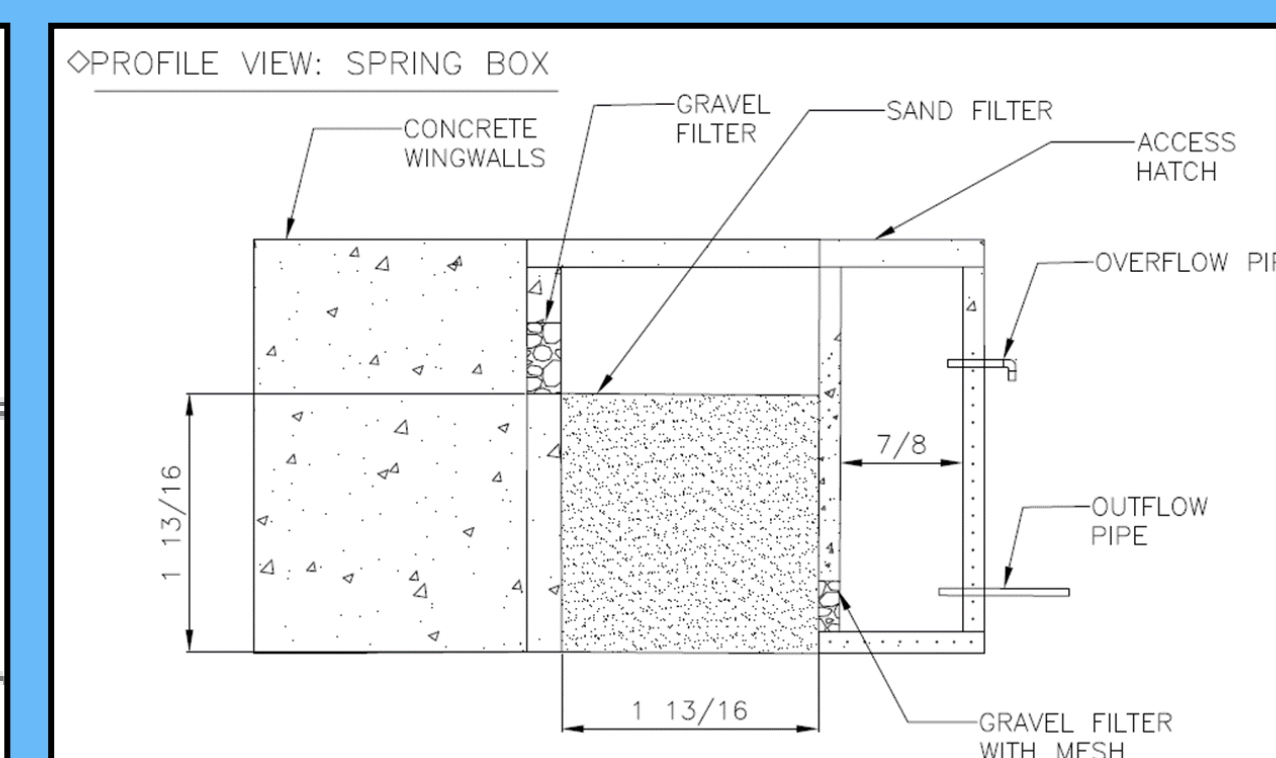


Figure 5: Profile View Spring Box (units: m)

Toma 2 Design

Due to elevation problems, the most sustainable option to provide water to the last three houses in Northern Vallecito is to utilize Toma 2 and provide one communal tap stand. The system is made of 1 inch diameter PVC pipe. The elevation profile and tap stand are illustrated in Figures 8 and 9.

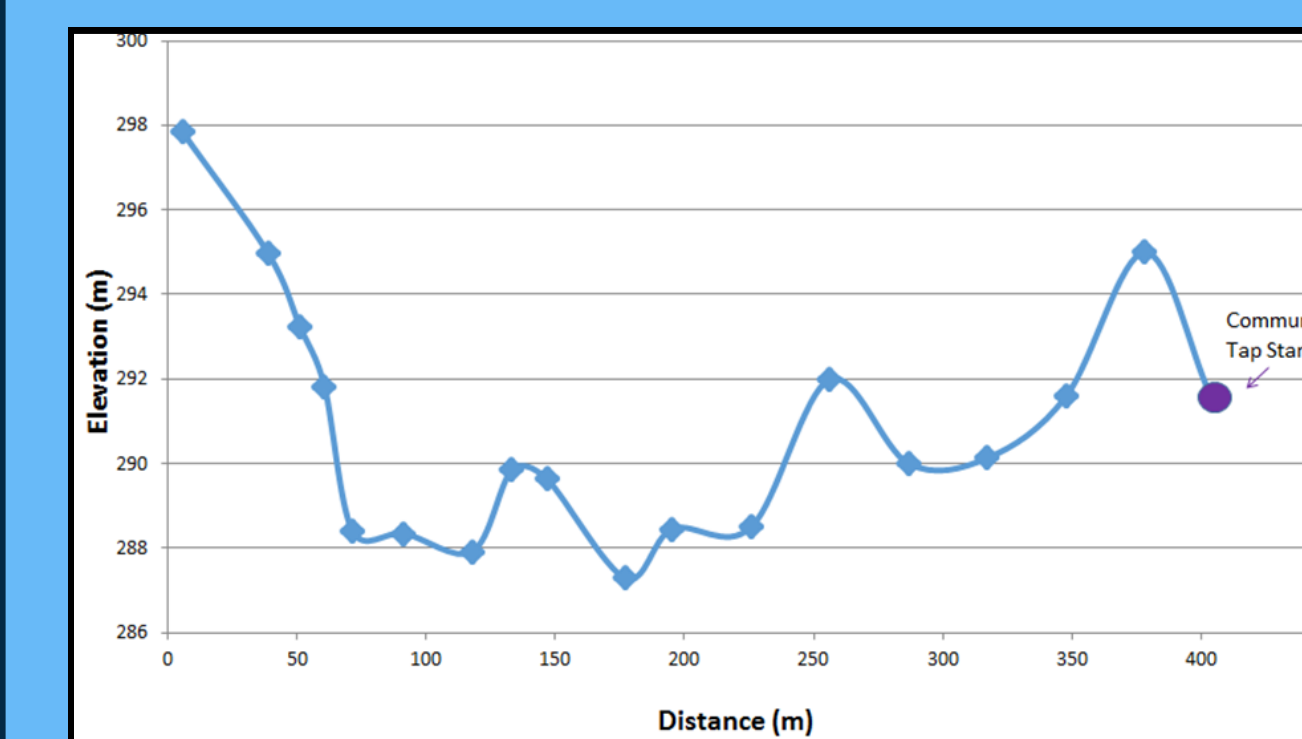


Figure 8: Toma 2 Elevation Profile

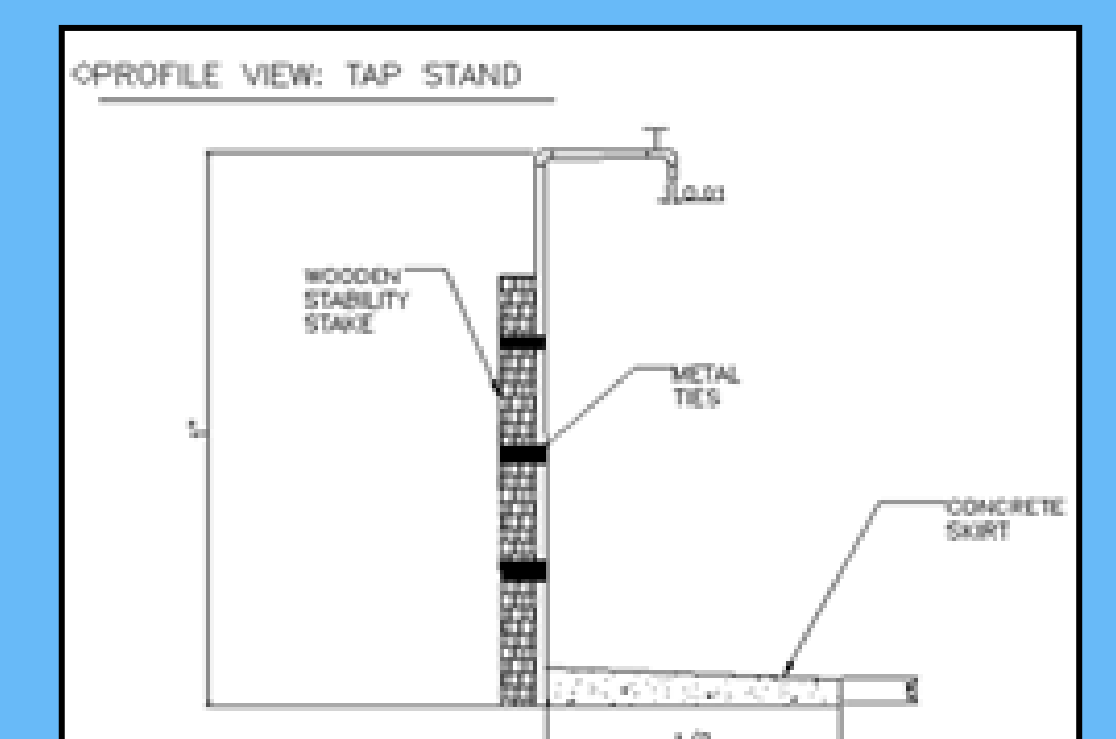


Figure 9: Tap Stand Profile

Conclusion

- Developed an affordable and sustainable gravity fed water distribution system for community
- Designed to be durable yet easy to maintain with unique components to meet the needs of the community
- Next steps include obtaining Peace Corps approval and fundraising